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McCallister et al.

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[54] CONSTRAINED-ENVELOPE  
DIGITAL-COMMUNICATIONS  
TRANSMISSION SYSTEM AND METHOD  
THEREFOR

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[56] References Cited

## U.S. PATENT DOCUMENTS

5,049,832	9/1991	Cavers	330/149
5,287,387	2/1994	Birchler	375/60
5,381,449	1/1995	Jasper et al.	375/59
5,479,448	12/1995	Seshadri	375/267
5,579,342	11/1996	Crozier	375/296
5,600,676	2/1997	Ramesh	375/283
5,606,578	2/1997	O'Dea	375/298
5,621,762	4/1997	Miller et al.	375/298
5,629,961	5/1997	Kawabata	375/308
5,638,403	6/1997	Birchler et al.	375/296
5,638,404	6/1997	Crozier	375/296
5,696,794	12/1997	O'Dea	375/296
5,727,026	3/1998	Beukema	375/296
5,805,640	9/1998	O'Dea et al.	375/296
5,987,068	11/1999	Cassia et al.	375/281

## OTHER PUBLICATIONS

Amoroso, Frank and Monzingo, Robert A., "Digital Data Signal Spectral Side Lobe Regrowth in Soft Saturating Amplifiers", *Microwave Journal*, Feb. 1998, pp. 126-131.  
Amoroso, Frank and Monzingo, Robert A., "Spectral Side-lobe Regrowth in Saturating Amplifiers", *Applied Microwave and Wireless*, Mar. 1998, pp. 36-42.  
Miller, Scott L. and O'Dea, Robert J., "Adaptive Peak Suppression for Power and Bandwidth Efficient Linear Modulation", IEEE.

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## [57] ABSTRACT

A constrained-envelope digital-communications transmitter circuit (22) in which a binary data source (32) provides an input signal stream (34), a phase mapper (44) maps the input signal stream (34) into a quadrature phase-point signal stream (50) having a predetermined number of symbols per unit baud interval (64) and defining a phase point (54) in a phase-point constellation (46), a pulse-spreading filter (76) filters the phase-point signal stream (50) into a filtered signal stream (74), a constrained-envelope generator (106) generates a constrained-bandwidth error signal stream (108) from the filtered signal stream (74), a delay element (138) delays the filtered signal stream (74) into a delayed signal stream (140) synchronized with the constrained-bandwidth error signal stream (108), a complex summing circuit (110) sums the delayed signal stream (140) and the constrained-bandwidth error signal stream (108) into a constrained-envelope signal stream (112), and a substantially linear amplifier (146) amplifies the constrained-envelope signal stream (112) and transmits it as a radio-frequency broadcast signal (26).

29 Claims, 4 Drawing Sheets

